IDENTIFYING AND PROTECTING URBAN TRANQUILLITY

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1 INTRODUCTION

This paper describes the research and work which has been undertaken to inform Westminster City Council policy on the identification and protection of urban tranquillity within the borough.

In 2007 Westminster City Council committed to producing an overarching noise strategy. The main aim of the Strategy is to contribute to improving the health and wellbeing of Westminster's residents, workers and visitors by reducing noise pollution and enhancing the city's sound environment. One of the key objectives of the strategy is 'Protecting and creating tranquil areas and sounds with positive associations'. In order to promote and achieve that objective, a main policy heading; 'Policy 4 Tranquil areas and positive sounds' is incorporated into the Strategy. A number of goals and actions sit under Policy 4; notably;

- Ensuring new development (which includes changes of land use or the intensity of an activity)… …do not lead to increased noise intrusion (in relation to open spaces).
- Identifying existing tranquil spaces suitable for additional protection and enhancement

To underpin Policy 4, Westminster commissioned a study into tranquillity which was carried out by Scott Wilson (now URS). The Westminster Open Space Study 2008 can be downloaded from the Council's website [1]. The work involved a mixture of desktop research on selected open space sites, attitudinal surveys of park users, and noise measurements. From the study a Tranquillity Rating toolkit was devised which would allow a Tranquillity Rating (TR) score to be assigned to each open space.

The research and work carried out by the author summarized within this paper has extended the work which was previously conducted, but also goes further by establishing a Tranquil designation matrix which is used in order to have robust rationale and officer support for policy decisions in relation to identifying and protecting Tranquil Open Spaces. The methodology could also be considered as a step to Identifying 'Quiet Areas' as specified under the European Environmental Noise Directive. The author also undertook work on the 'relative' nature of noise and urban tranquillity, by carrying out synchronized noise monitoring, within open spaces and the surrounding vicinity. This paper gives an overview of the methodology and results.

2 REVIEW AND RESEARCH ON THE BENEFITS OF OPEN SPACES

2.1 Restorative Health and Wellbeing

A review of relevant literature was split into main areas of consideration in order to incorporate all of the issues and current understanding on the topic.

- Health and Wellbeing (related to exposure to noise and lack of access to open spaces)
- Tranquillity
- Quiet areas
- Soundscape and positive sound in open spaces,
- Projects, initiatives, pilot schemes in Open space tranquillity, quiet and soundscapes
- Relevant Legislation, Policy, Strategy and Guidance

A summary of the 'health and wellbeing' research has been presented below:
A central reason for protecting quiet and tranquillity is health and wellbeing, especially for those that do not have access to their own private open space and/or suffer from high exposure to noise. Public open spaces and other similar external resources are crucial for relaxation, physiological restoration and reversing effects of stress and anxiety. This in turn can help an individual cope with living and working within an urban environment. Added to this a 'quieter more tranquil space' can provide respite from high ambient noise and intrusive noise events, both of which have an impact on health.

Public open space may directly impact mental health via the restorative benefits arising from contact with nature (Herzog, T. et al 1997) [2]. Interestingly a recent study indicates that from a mental health perspective, the *quality* of Public Open Space appears to be more important than the quantity of Public Open Space (Francis, J. 2012) [3]. One study supports the notion that green space can provide a buffer against the negative health impact of stressful life events. (Van den Berg, A, E. et al 2010) [4]. For example, following the attacks on the World Trade Centre in 2001, managers of [U.S.] national parks observed a pronounced increase in the number of visits. Such nature-based coping strategies appear to be effective, as evidenced by a growing number of studies showing that contact with nature can have beneficial health effects ([De Vries et al., 2003], [Maas et al., 2006] and [Mitchell and Popham, 2007])*

Respite from high noise exposure is also essential; Ellen Mason, a cardiac nurse at the British Heart Foundation, said:

> *"Our world is undoubtedly getting busier and noisier. Some people find noise pollution more stressful to live with than others do. Noise cannot directly kill us, but it may add to our stress. Occasionally, stressful events can trigger a heart attack in someone with underlying heart disease. We know that stressed people are more likely to eat unhealthily, exercise less and smoke more, and these can increase the risk of developing heart disease in the first place."* [5]

The link between noise and health is now clearer than it has been in the past. A review in 2000 (Babisch, W. 2000) [6] highlighted 'some' epidemiological evidence of an increased risk of ischaemic heart disease (IHD) in subjects who live in noisy areas with outdoor noise levels of more than 65-70 dBA. However, further evidence has come to light since then. A report by Den Boer & Schroten (2007) [7] states; *"over 245,000 people in the EU25 are affected by an IHD due to [road and rail] traffic noise annually, of whom 94% (approx. 231,000) [are] due to road traffic noise. About 20% (almost 50,000) of these people suffer fatal heart attacks…"*

The environmental burden of disease due to environmental noise has been recently estimated for western European countries with a range of 1.0–1.6 million DALYs† lost across all health outcomes (WHO, 2011) [8]. The estimates are 61,000 DALYs for IHD, 45,000 for cognitive impairment of children, 903,000 for sleep disturbance, 22,000 for tinnitus, and 587,000 for annoyance.

2.2 Health in London

In December 2007 Berry Environmental Limited was commissioned, by the Noise Strategy Team at the Greater London Authority (GLA) to consider the cardiovascular risk factors arising from ambient / environmental noise within London.

The Berry report calculated its estimates using 2006 health statistics available for the GLA area. The estimated number of people in the GLA area potentially affected by Acute Myocardial Infarction (AMI) as a result of exposure to Road Traffic Noise is 108, or about 1.8% of the total number of cases of AMI [5991 in London 2001]. For IHD, the estimated number of people in the GLA area

*Extract from Van den Berg, A, E. et al 2010 – See Reference [4]

† DALYs = Disability Adjusted Life Years - The sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability

potentially affected as a result of exposure to Road Traffic Noise would be 499. From these figures the report went on to estimate approximately 50 potential deaths from AMI and 134 from IHD (Berry, B. 2008) [9].

Of course it is important to consider these estimates in context with other risks and causes of death and also it is essential to bear in mind that much of the health impact of noise is connected with exposure to 'prolonged' noise 'at night'. Public Open Spaces are obviously not often used for prolonged periods or during the night so they do not provide a like for like offset of risk. However, **the estimates of serious health impacts, and the nature of noise risk, highlights the vital need for individuals to have the 'opportunity' to escape from high ambient noise and have opportunity to recoup and recover from prolonged exposure and the side effects of sleep disturbance.**

Data from across Europe indicates that socially disadvantaged people often live in places with less access to public green space (Kruize et al., 2007; Bolte, Tamburlini and Kohlhuber, 2010) [10]. This is something that no doubt applies to many parts of London.

A review of current research demonstrates that better access to higher quality open space in terms of tranquillity and quiet is advantages to individuals who live and work within urban areas as these individuals typically suffer from higher noise levels and noise events. However, a study conducted by Gidlof-Gunnarsson and Ohrstrom (2007) [11] concludes *"To achieve a long-term sustainable and health-promoting urban residential environment it is essential to strive for lower sound levels at the residencies but also in the close neighbourhood (Klaeboe et al., 2005), to assure access to "noise-free" places or a quiet side, as well as to protect, preserve and increase the supply of nearby green areas."*

This highlights that access to quiet / tranquillity is not solely a solution to the health issues considered above. Noise levels *where people live* also need to be reduced, and at this point it should be noted that this is one of the main purposes of the Environmental Noise Directive (2002/49/EC). However, the research demonstrates that access to high quality open spaces is essential, especially in urban areas, where people are more likely to be exposed to prolonged high ambient noise and noise intrusive events.

2.3 Is 'quiet' the answer?

From the research carried out, including the Westminster Open Spaces Study, it is evident that the 'relative' tranquillity, noise level and/or the 'relative' absence of man-made noise sources are a key consideration in an urban context. While the search for 'quiet' is vitally important, it should not be taken out of context and used as an absolute threshold when assessing inner city open spaces.

In Amsterdam, a study conducted by the Department for Research and Statistics and Public Health Services (Booi, H. and van den Berg, F. 2012) [12] found that *"The need for quietness is strongly related to noise sensitivity and the perception of sound. When sound is perceived as a negative factor (noise from transportation and people) there is a higher need for quietness, but as a positive factor (perceived liveliness at home/in neighbourhood) it reduces that need."*

However, perhaps even more pertinent to this study of relative tranquillity in Westminster is the concluding remarks made in the Amsterdam report; *"As Jane Jacobs argued, a city flourishes because of diversity: in people, use of public space, architecture, etc. (Jacobs, J. 1993). This also applies to the soundscape: there must also be diversity in the sonic/acoustic environment. A city can be very noisy, but that is less of a problem if its inhabitants have access to quiet places: a quiet home and a quiet place outdoors… ...Quietness and* ***also*** *liveliness (in terms of sound) are positive qualities."* (authors Highlighting) The conclusions of the Amsterdam report show, to some extent, that strict reliance upon 'Quiet' (i.e. levels under a threshold) is not the be-all and end-all within a city centre and therefore although 'Quiet Areas' might be identified within a city it is also important to consider relative tranquillity within areas which may not have such low noise levels and are vibrant

or known for the liveliness of sound. Of course, a balance has to be struck; Leicester Square, although by far, not the 'loudest' open space surveyed, it is vibrant and known for its lively Soundscape, but would a person venture to that space for its perceived tranquillity and / or restorative qualities? Perhaps not, it is a good example of how 'acoustics' is only one factor in this complex issue.

3 ASSESSMENT METHODOLOGY

3.1 Open Space Toolkit and Noise Measurement Surveys

As part of the follow up work by the author a further 11 sites where surveyed by using the Tranquillity Rating toolkit along with noise measurements.

Table 1 shows the sites which have been surveyed as part of this paper which are added to the 20 previous sites as part of the 2008 Open Spaces Study

Civic Paved Space	Local Mixed Surface Space	London Park	Civic Mixed Surface Space
	Westbourne Estate Canalside Gardens Queens Park Gardens Edbrooke Road Gardens Shrewsbury Road Porchester Square St Stephens Gardens Temple Gardens St Georges Square Violet Hill Gardens Christ Church Gardens St John's Wood Church Golden Square	St James's Park	

Table 1 – Table showing a list of the 11 sites studied as part of this study as well as the sites re-evaluated – Those highlighted in Yellow are the 2 sites which have had detailed surveys carried out. Those highlighted in Blue are the sites which were also assessed by URS / Scott Wilson in the 2008 study

All Sound Level Meters used in this study were Class 1 meters (or Type 1 for older machines) and all meters and microphones were within 2 years UKAS accredited calibration and all calibrators used were within 1 year accredited calibration. Onsite calibration was carried out before and the calibration tone was checked after each measurement without notable drift.

All measurements were taken at a height of 1.5 metres above the ground with the microphone positioned on a tripod. All measurements were taken in a free field position. For the purpose of this study, all measurements were only obtained on days when the weather was fine (it's no good researching open spaces without a little sunshine). For the majority of surveys a 5minute measurement interval was taken and the following broadband acoustic parameters L_{Aeq}, L_{A90}, L_{AFmax}, L_{A10}, and L_{A99} were obtained. The measurements were approximately an hour in duration between the hours of 12:00 – 16:00. The measurement position was generally at a central location. However, other positions were taken subject to the open space having various different spaces which may have had different acoustic characters.

At two of the sites (highlighted yellow in Table 1 above, detailed measurements were taken using 15second measurement intervals. The same main acoustic parameters were obtained as with all sites. However, in addition the sound level meters were set up to measure Broadband and 1/3 octave measurement data.

The methodology at these two locations was slightly different then the other surveys. At these locations two measurement data sets were obtained by using two time synchronised sound level meters. The first sound level meter was set up in the center of the open space and the second was

moved around the surrounding vicinity of the open space including the perimeter and streets in close proximity. The sound level meter within the open space was set up on a tripod and the measurements taken in the surrounding areas were taken handheld and also while walking from 1 position to another. The measurements were each taken over an approximate 30 minute period.

The following **Figure 1 and 2** below show the position of the measurements for the two detailed surveys.

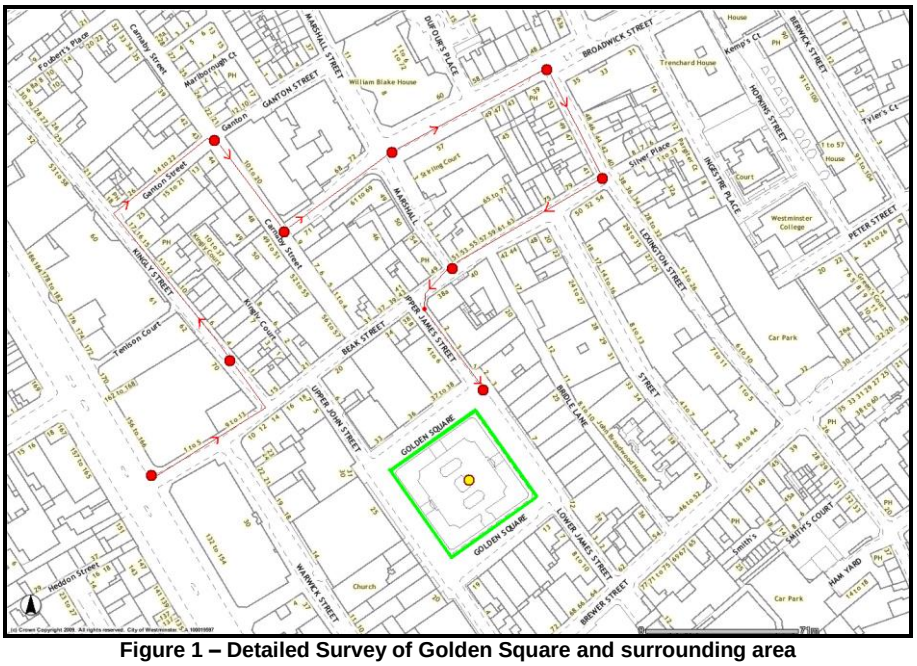

Figure 1 – Detailed Survey of Golden Square and surrounding area

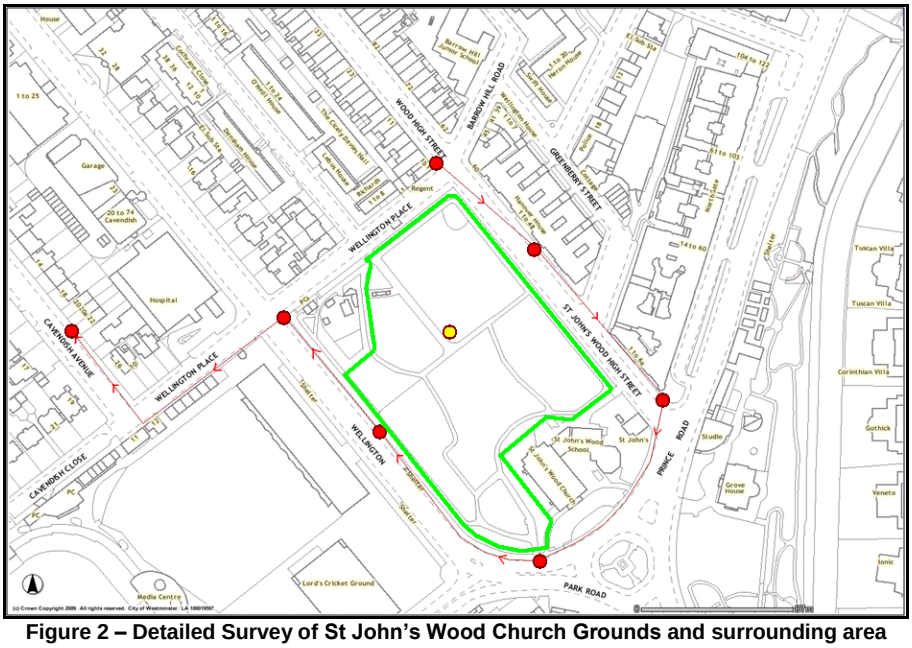

Figure 2 – Detailed Survey of St John's Wood Church Grounds and surrounding area

Along with each acoustic survey the author carried out the Westminster Tranquillity Toolkit tick sheet survey to obtain the TR Score for each open space.

4 RESULTS

4.1 Results of the Overall TR and dB Level results (All Sites)

The results of the TR Score and measured ambient and background levels for **all** sites have been shown in **Figure 3 and 4** below. Note the primary and secondary y axis are not related (Secondary axis shows TR Scores)

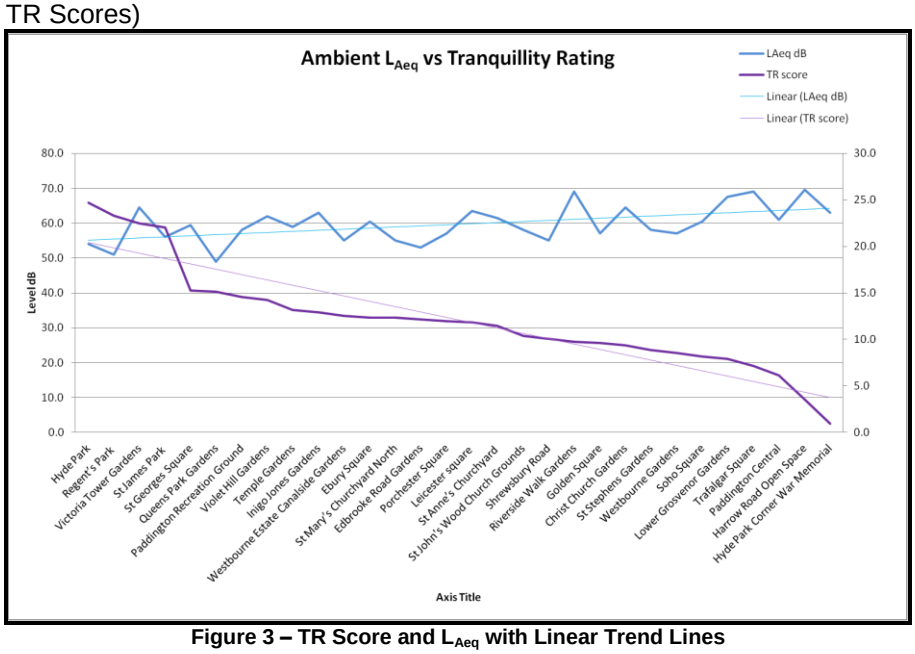

Figure 3 – TR Score and L_{Aeq} with Linear Trend Lines

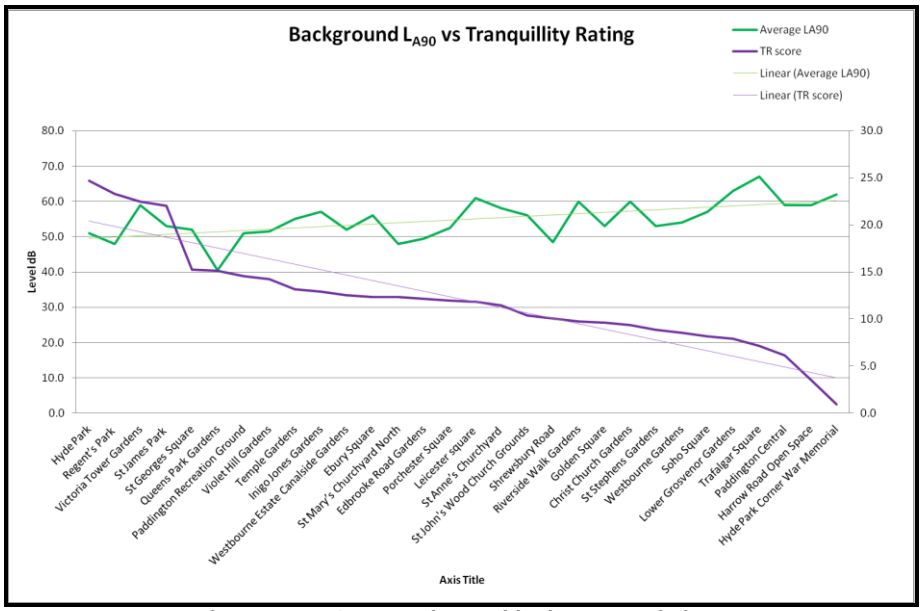

Figure 4 - TR Score and L_{A90} with Linear Trend Lines

4.2 Results of detailed time synchronised survey

The following is an example of the results from the detailed survey; **Figure 5** shows L_{AFmax}, L_{Aeq} and L_{A90} of the middle of the open space in comparison with the L_{AFmax} and L_{Aeq} of the surrounding vicinity. **Figure 6** shows the 1/3 Octave data comparison with the middle of the open space with that of surrounding areas.

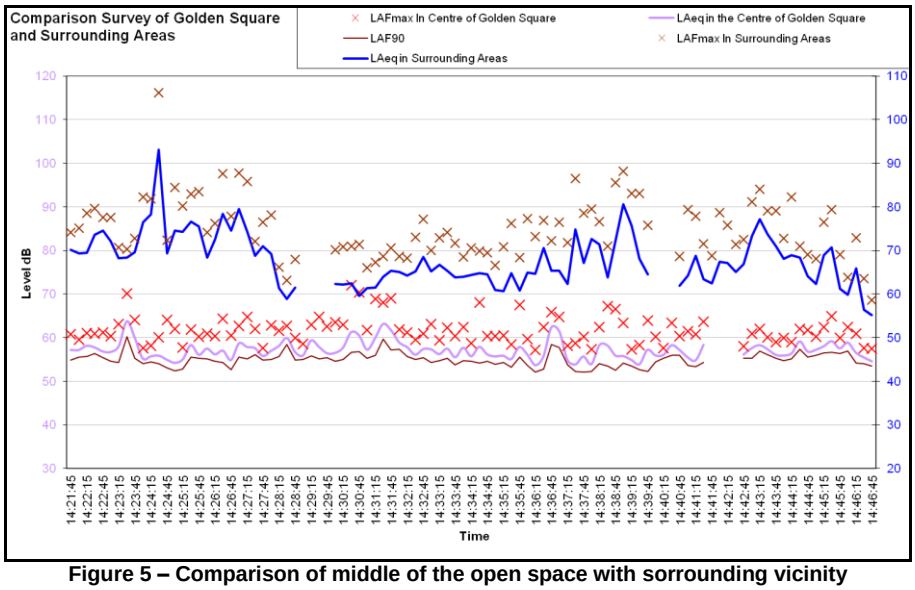

Figure 5 – Comparison of middle of the open space with sorrounding vicinity

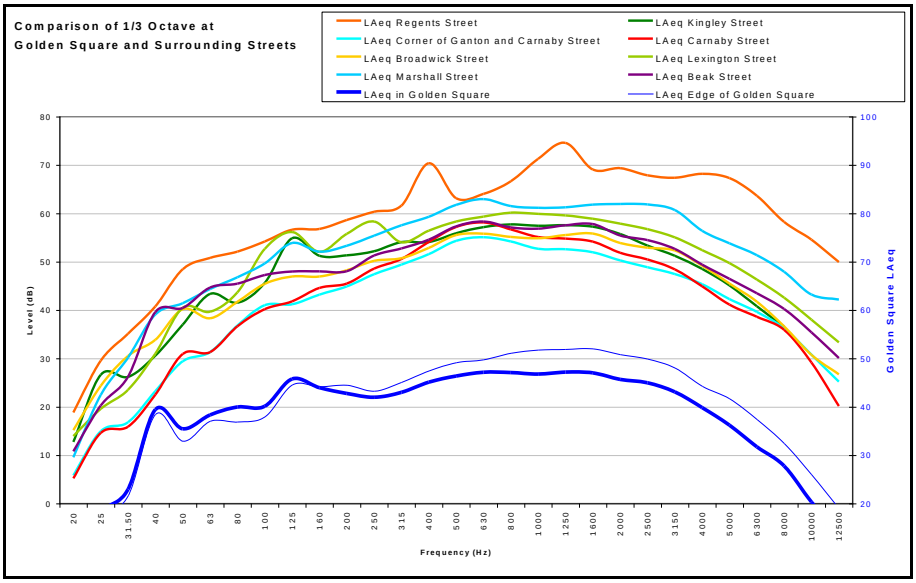

Figure 6 – Comparison of A Weighted 1/3 Octave Data between the middle of open space with sorrounding vicinity

5 DISCUSSION

5.1 Discussion of the Overall TR and dB Level results (All Sites)

The resurveys (Highlighted Blue in **Table 1**) conducted at Golden Square and St James' Park showed a very good level of consistency with the surveys conducted by URS/ Scott Wilson. The TR scores were within 0.5 point difference, and the L_{Aeq} levels where within ±2 dB deviation of the original surveys. The overall L_{Aeq} results support the premise that 'urban' open space is not often 'quiet', and the well established WHO guidance on external noise levels (i.e. <50 dB L_{Aeq}) is certainly desirable but not always met within an urban context. The arithmetic average L_{Aeq} and L_{A90} for all sites is 60 dB and 55 dB respectively. **Figure 3 and 4** appear to show a very weak correlation between the Tranquillity Rating and Noise Level. Originally from the findings in the 2008 URS / Scott Wilson report it was stated that no correlation was found between the tranquillity rating and noise level. It is possible that a larger number of sites which have been considered have provided a better exploration of this factor. Taking all the sites into consideration shows an average overall

Tranquillity Rating (TR) of 12 TR. The Tranquillity Rating is contributed by positive and negative scores derived by the presence of various perceptual features (for instance bird song gives a positive score, people talking on the phone gives a negative score). The average positive score for all sites is 14, and -2 for the average negative score.

5.2 Discussion of detailed time synchronised survey

The results from the 2 detailed surveys (e.g. Figure 5) clearly highlight the anticipated 'relative' nature of noise within a park to the areas around it. The L_{AFmax} levels show that parks may have a calmer acoustic nature with more steady and less high impulsive noise and noise events then the surrounding areas.

The 1/3 Octave analysis (e.g. Figures 6) shows that the acoustic character of sound within the surrounding areas is perhaps more 'colourful' then within an open space. However, caution should be applied to this hypothesis because the monitoring durations of each spectrum are not comparable. It could be that the 1/3 octave spectrum within the centre of the open spaces measured had more time to settle and become more of a broadband response.

6 CONCLUDING REMARKS

6.1 Informing policy

It is not an unreasonable conclusion to draw; that 'above' average, in terms of TR score, is likely to be a positive indication of tranquillity and conversely an 'above' average L_{Aeq} dB level is likely to be a negative indication for the purposes of identifying 'relative' tranquillity. Following the findings of this study and the research which accompanied this work; it was decided by the author and the Senior Environmental Planning Policy Officer at Westminster City Council to consider >12 TR and <60 dB L_{Aeq} to be the main 'starting' thresholds of relative tranquillity. However, it is reasonable to have some scope / discretion around those figures. From this research, it was proposed that a space scoring a TR score of 8 or less was extremely unlikely to be tranquil. A subjective review of the open spaces which fell into this category certainly backed this objective methodology up. Added to this, it was determined that it would be difficult to justify tranquillity and 'relative' quiet in open spaces which have levels measured over 65 dB L_{Aeq}. This level is significantly higher than the WHO guidance (+10 – 15 dB higher). Also research including Babisch (2000) [6] shows a link with increased health risks at levels above 65 dB. Other research also shows a trend that people's perception of the 'quality' of the soundscape is likely to drop off substantially with dB levels above 65 dB, for example 'Soundscape quality in urban open spaces' (Nilsson, 2007) [13]. Therefore, there would be little benefit of designating a tranquil space if it still suffered from the levels of noise for which people may wish to escape.

Based upon these threshold levels the following Tranquillity Designation Matrix system was developed by the author to inform the planning policy;

	No Tranquillity categorisation	=	≤8 TR and / or ≥65 dB L_{Aeq}
	Discretionary tranquillity category	=	between 8 – 12 TR and / or 60 – 65 dB L_{Aeq}
	Positive identification of tranquillity	=	≥14 TR and / or ≤60 dB L_{Aeq}

The following visualisation of this category matrix (shown in **Figure 7 and 8**) was developed by the author.

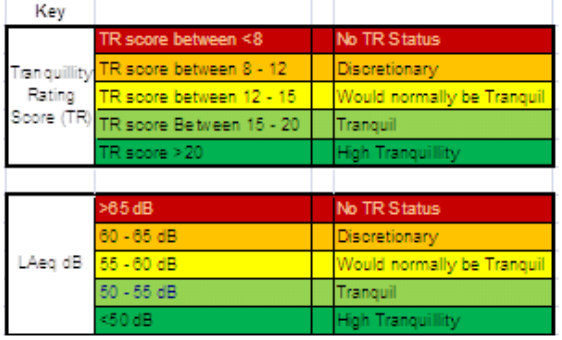

Figure 7

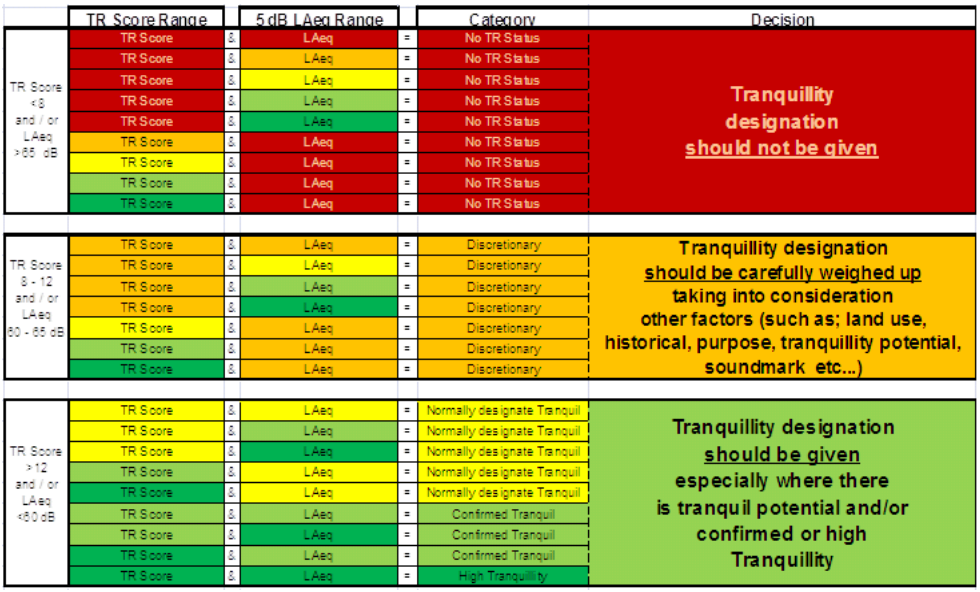

Figure 8 – Visualization of the Tranquillity category matrix

6.2 Overall Conclusions

There is no direct correlation between WCC Tranquil designation and Noise level alone as it incorporates other senses and factors such as sight, touch, smell, security, facilities etc… However, there is some weak correlation to indicate that generally as noise levels increase the perception of tranquillity may diminish. From the category system put forward in this paper (which is based upon average figures and other clear threshold indicators (such as ≥65 dBA)), there appears to be a strong correlation with the rationale and a subjective knowledge and experience of the open spaces under consideration. High noise levels and poor TR scores should be taken into consideration when determining 'Tranquil Spaces' and this has been incorporated into the designation category system. L_{Aeq} Levels of <55 dB are often not achievable within inner city open areas and it should be considered that a 'relative dB value' is considered in terms of 'urban tranquil spaces'. Possible Planning Conditions could seek to reduce L_{Aeq} levels over time within inner city areas and protect tranquil spaces from unwanted sound. L_{AFmax} events appear to be a lot steadier within an open space then when compared to surrounding areas. This is a useful way of quantifying noise in tranquil spaces, but requires more detail surveys. A robust assessment tool has been developed for Westminster to shape policy and protect Urban Tranquillity. The assessment methodology and designation matrix could also be extended to include the identification and designation of END 'Quiet Areas'.

7 ACKNOWLEDGEMENTS

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